



VEBKO ONLINE HELP

Writing Formula for “XRIO Converter”5

Category	tester
Section	Modules Toolbar and Statusbar
Language	English
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In the previous video, the information regarding "Device" block and some parts of "Overcurrent" block such as "General", "CT" and "VT" were completely covered. As mentioned before, under the "Elements" tab by double-clicking on "Overcurrent" block, "Normal Inverse" curve is selected for "51" function; the information related to this curve is located in "Overcurrent Elements" block. Now we are going to complete the "Overcurrent Elements" block information.

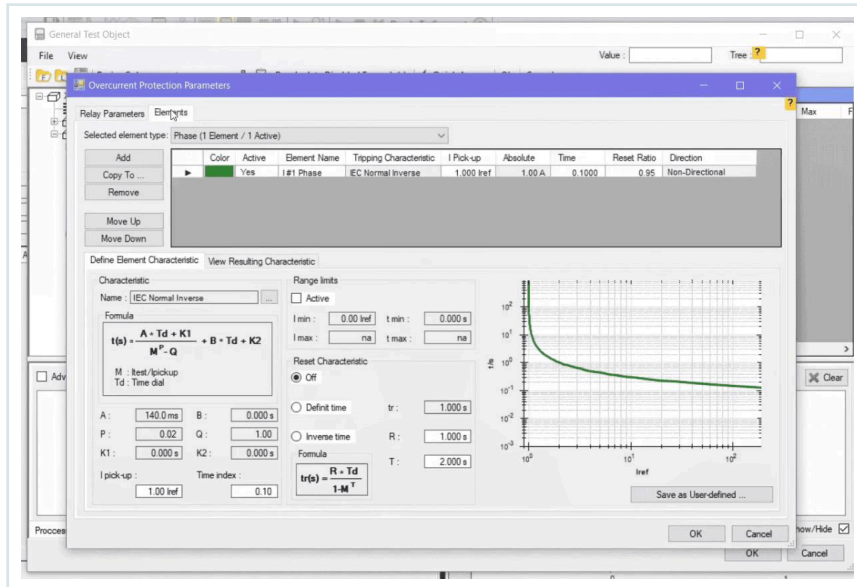


Figure 1

Enabling a characteristic curve: As you can see, activeness or inactiveness of the characteristic curves is determined in "Active" column. To link the value of this parameter which is located in the "Timed Overcurrent Element" block, by following the mentioned steps in previous videos, in "Add Ref.Param" window in "Device Config" block, "50/51" parameter with "Enumeration=Time Overcurrent IEC" and "ID=TX1_3_101" is selected and in "51" block, "IEC Curve" parameter with "Enumeration=Normal Inverse" with "ID=TX1_1_51" is selected and added to "References" section. Then, the formula is written as "OC_101=TX1_3_101 AND CURVE_51=TX1_1_51". To validate the written formula, click on "Test" and finally click on "OK".

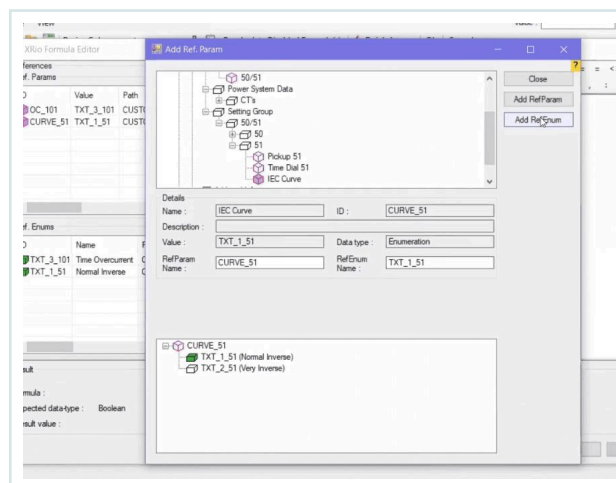


Figure 2

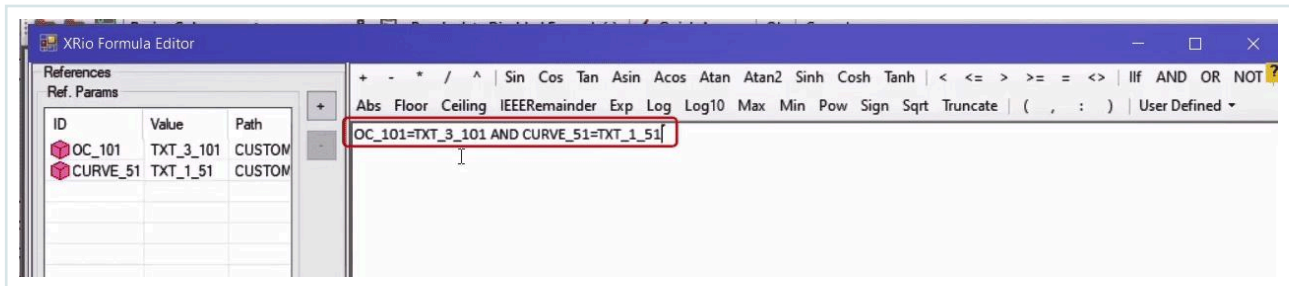


Figure 3

Determining the value of `lpickup.nom`: The parameters related to "lpickup" current and its tolerances are located in "Pick up Current" block. To link the current value of "lpickup" whose value is a coefficient of "IREF", double click on "State" column and by clicking on icon "..." in "Value Properties" section, click on "+" on "XRIo Formula Editor" window and select parameter "Pickup 51" from "51" block and "Reference Current" parameter from "General" block on the "XRio" tree diagram to add them to "References" section. Then, using the "ID" of added parameters, the formula is written in the box at the right side as "PICKUP_51/IREF". The formula is validated by clicking on "Test". The value of "lpickup.nom" parameter is calculated in accordance with that the value of "Pickup 51=1A" in "51" block and the value of "CT Secondary=1A" in "CT'S" block.

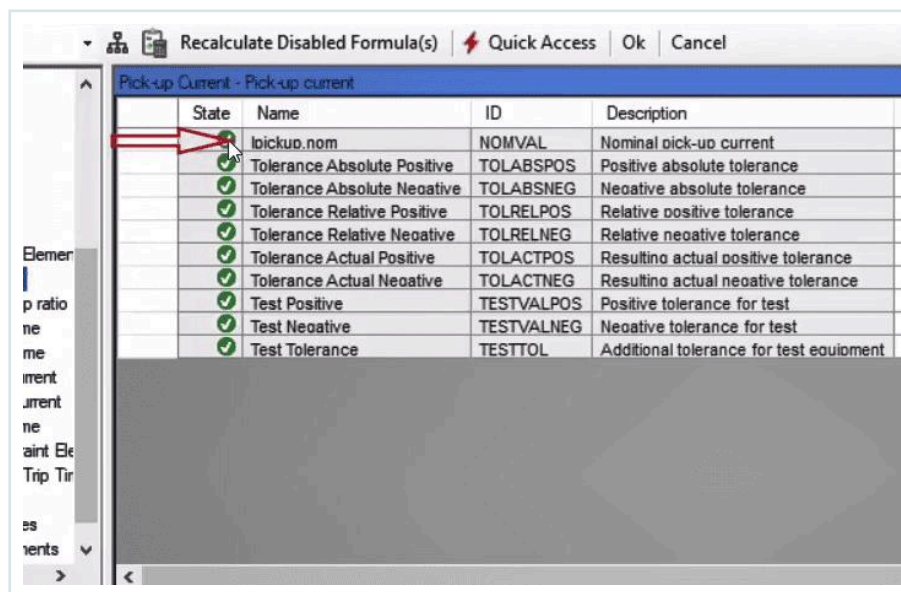


Figure 4

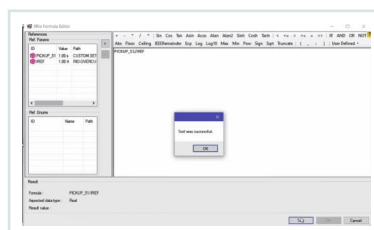


Figure 5

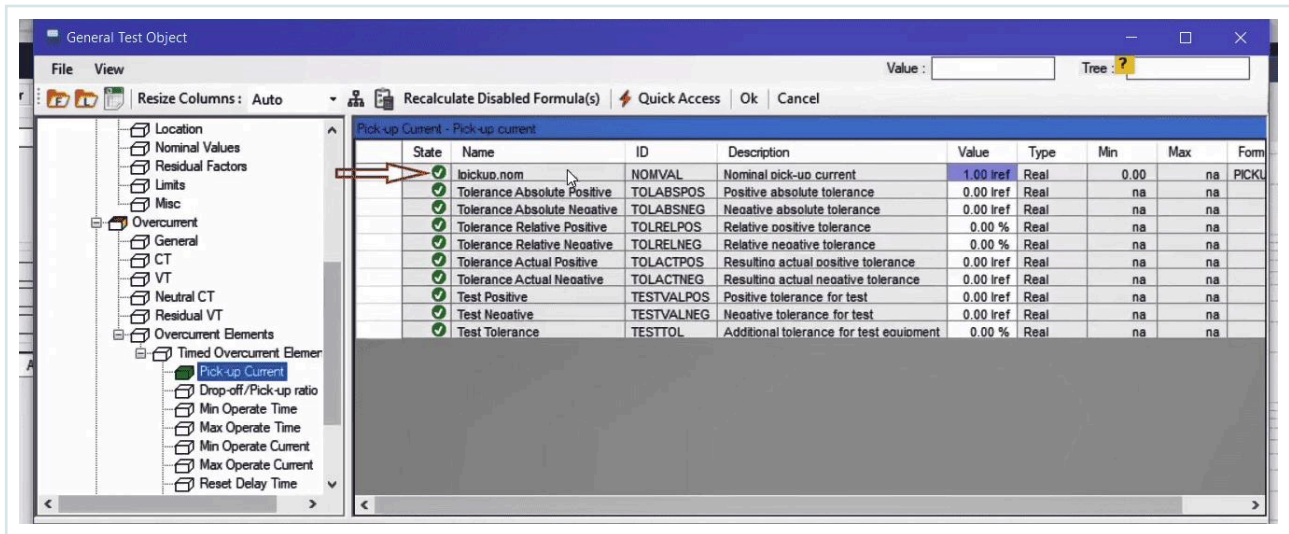


Figure 6

Determining the current tolerances: To link the value of "Tolerance Absolute Positive" parameter with "Current Tolerance Minimum" parameter, by following the mentioned steps from the "XRio" tree diagram, in the "General" and "Overcurrent" blocks from the "Rio" section, the "Current Tolerance Minimum" parameter is added to "References" section and the formula is written as "CURRENTTOLABS" in the box at the right side and then the formula is validated.

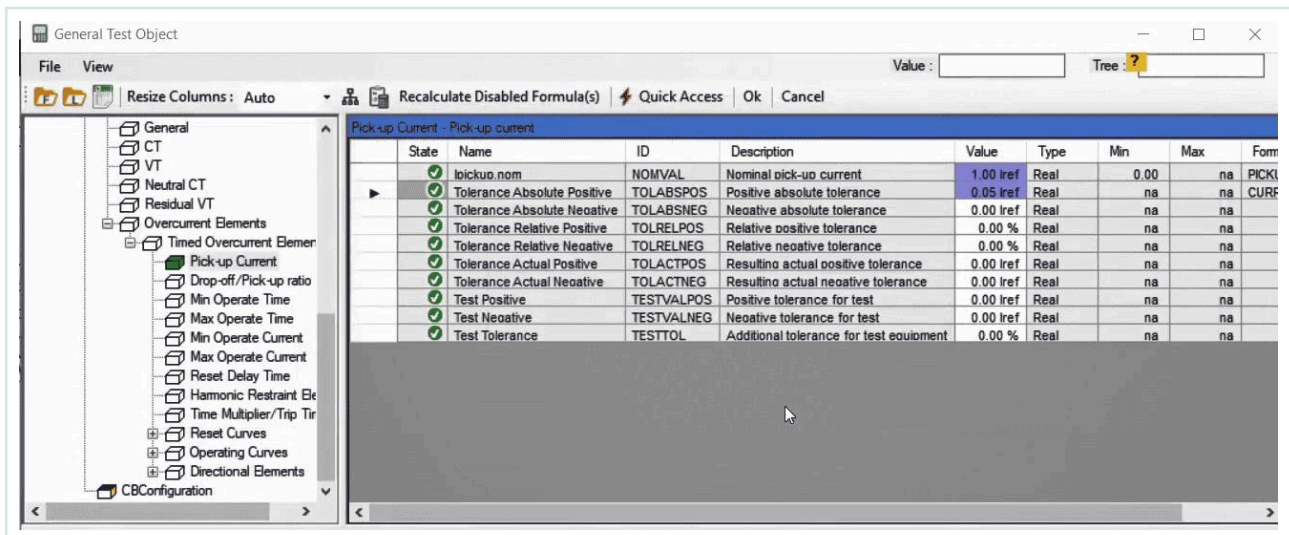


Figure 7

Likewise, the values of "Tolerance Absolute Negative", "Tolerance Relative Positive" and "Tolerance Relative Negative" parameters are linked with parameters with "ID=CURRENTTOLABS", "ID=CURRENTTOLREL" and "ID=CURRENTTOLREL" respectively. The "Tolerance Actual Positive" parameter selects the highest amount of positive tolerance from "Tolerance Absolute Positive" and

"Tolerance Relative Positive" and based on a percentage of "IREF" puts it in its "Value" field. So, by following the previous steps and adding "Ref.Params", the formula is written as " $\text{Max}(\text{TOLABSPOS}, \text{TOLRELPOS} * \text{NOMVAL} / 100)$ " and validated.

Pick-up Current - Pick-up current									
State	Name	ID	Description	Value	Type	Min	Max	Formula	
✓	lockup.nom	NOMVAL	Nominal pick-up current	1.00 Iref	Real	0.00	na	PICKUP_51/REF	
✓	Tolerance Absolute Positive	TOLABSPOS	Positive absolute tolerance	0.05 Iref	Real	na	na	CURRENTTOLABS	
✓	Tolerance Absolute Negative	TOLABSNEG	Negative absolute tolerance	0.05 Iref	Real	na	na	CURRENTTOLABS	
✓	Tolerance Relative Positive	TOLRELPOS	Relative positive tolerance	5.00 %	Real	na	na	CURRENTTOLREL	
✓	Tolerance Relative Negative	TOLRELNEG	Relative negative tolerance	5.00 %	Real	na	na	CURRENTTOLREL	
✓	Tolerance Actual Positive	TOLACTPOS	Resulting actual positive tolerance	0.00 Iref	Real	na	na		
✓	Tolerance Actual Negative	TOLACTNEG	Resulting actual negative tolerance	0.00 Iref	Real	na	na		
✓	Test Positive	TESTVALPOS	Positive tolerance for test	0.00 Iref	Real	na	na		
✓	Test Negative	TESTVALNEG	Negative tolerance for test	0.00 Iref	Real	na	na		
✓	Test Tolerance	TESTTOL	Additional tolerance for test equipment	0.00 %	Real	na	na		

Figure 8

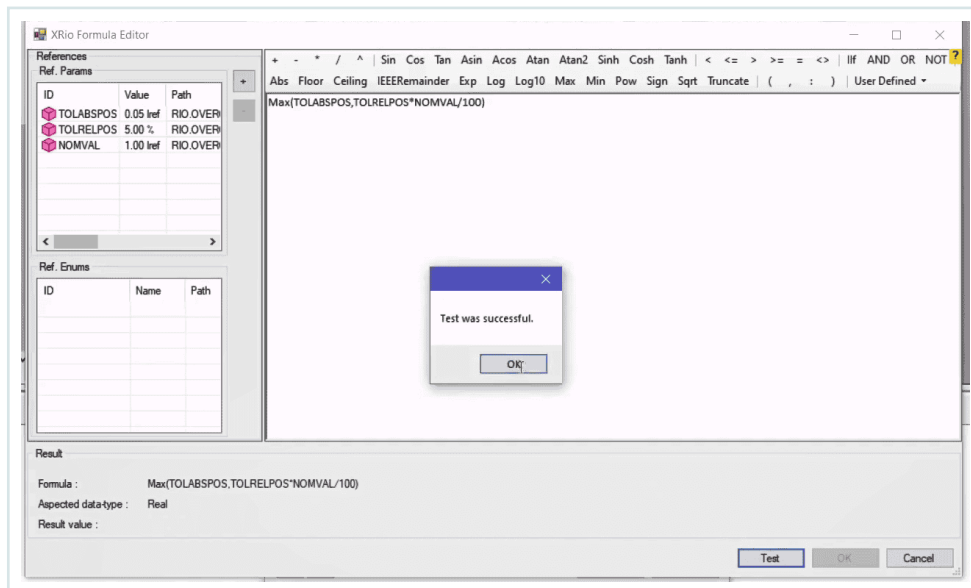


Figure 9

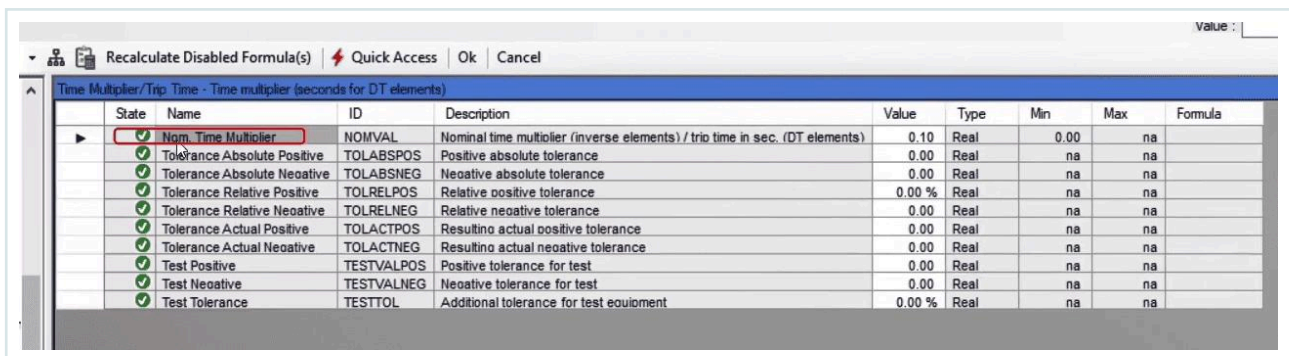
"Tolerance Actual Negative" parameter is almost the same as the previous parameter. The only difference is that it calculates the highest amount of negative tolerance and its formula is written as " $\text{Max}(\text{TOLABSNEG}, \text{TOLRELNEG} * \text{NOMVAL} / 100)$ ". Also, for "Test Positive" parameter, the formula is written as " $\text{NOMVAL} + \text{TOLACTPOS} + \text{NOMVAL} * \text{TESTTOL} / 100$ ". This parameter shows the maximum total error of the test which may occur because of measurement error of current transformers, test device, noise, etc. in "Test Negative" parameter, the formula is written as " $\text{NOMVAL} - \text{TOLACTNEG} - \text{NOMVAL} * \text{TESTTOL} / 100$ " which shows the minimum total error of the test.

Pick-up Current - Pick-up current									
State	Name	ID	Description	Value	Type	Min	Max	Formula	
✓	lockup.nom	NOMVAL	Nominal pick-up current	1.00 Iref	Real	0.00	na	PICKUP_51/REF	
✓	Tolerance Absolute Positive	TOLABSPOS	Positive absolute tolerance	0.05 Iref	Real	na	na	CURRENTTOLABS	
✓	Tolerance Absolute Negative	TOLABSNEG	Negative absolute tolerance	0.05 Iref	Real	na	na	CURRENTTOLABS	
✓	Tolerance Relative Positive	TOLRELPOS	Relative positive tolerance	5.00 %	Real	na	na	CURRENTTOLREL	
✓	Tolerance Relative Negative	TOLRELNEG	Relative negative tolerance	5.00 %	Real	na	na	CURRENTTOLREL	
✓	Tolerance Actual Positive	TOLACTPOS	Resulting actual positive tolerance	0.05 Iref	Real	na	na	$\text{Max}(\text{TOLABSPOS}, \text{TOLRELPOS} * \text{NOMVAL} / 100)$	
✓	Tolerance Actual Negative	TOLACTNEG	Resulting actual negative tolerance	0.05 Iref	Real	na	na	$\text{Max}(\text{TOLABSNEG}, \text{TOLRELNEG} * \text{NOMVAL} / 100)$	
✓	Test Positive	TESTVALPOS	Positive tolerance for test	1.00 Iref	Real	na	na	$\text{NOMVAL} + \text{TOLACTPOS} + \text{NOMVAL} * \text{TESTTOL} / 100$	
✓	Test Negative	TESTVALNEG	Negative tolerance for test	1.00 Iref	Real	na	na	$\text{NOMVAL} - \text{TOLACTNEG} - \text{NOMVAL} * \text{TESTTOL} / 100$	
✓	Test Tolerance	TESTTOL	Additional tolerance for test equipment	0.00 %	Real	na	na		

Figure 10

1 Determining trip time and the range of relay performance:

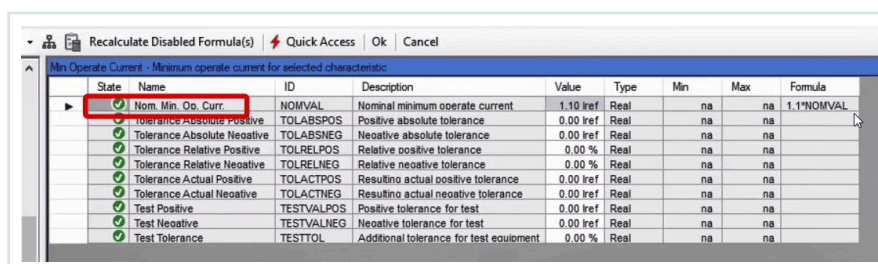
After determining current tolerances, the information related to "Time Multiplier/Trip Time" block should be completed. In this block, by following the mentioned steps, the value of "Nom.Time Multiplier" parameter should be linked with "Time Dial 51" parameter which is located in "51" block.



State	Name	ID	Description	Value	Type	Min	Max	Formula
✓	Nom. Time Multiplier	NOMVAL	Nominal time multiplier (inverse elements) / trip time in sec. (DT elements)	0.10	Real	0.00	na	
✓	Tolerance Absolute Positive	TOLABSPOS	Positive absolute tolerance	0.00	Real	na	na	
✓	Tolerance Absolute Negative	TOLABSNEG	Negative absolute tolerance	0.00	Real	na	na	
✓	Tolerance Relative Positive	TOLRELPOS	Relative positive tolerance	0.00 %	Real	na	na	
✓	Tolerance Relative Negative	TOLRELNEG	Relative negative tolerance	0.00	Real	na	na	
✓	Tolerance Actual Positive	TOLACTPOS	Resulting actual positive tolerance	0.00	Real	na	na	
✓	Tolerance Actual Negative	TOLACTNEG	Resulting actual negative tolerance	0.00	Real	na	na	
✓	Test Positive	TESTVALPOS	Positive tolerance for test	0.00	Real	na	na	
✓	Test Negative	TESTVALNEG	Negative tolerance for test	0.00	Real	na	na	
✓	Test Tolerance	TESTTOL	Additional tolerance for test equipment	0.00 %	Real	na	na	

Figure 11

According to "IEC" standard, the "Ipickup" current value of relays can range from "1.1" times to "1.3" times of the nominal current. Based on the manual of this relay, "1.1" is selected for this relay which means that the relay must not "Pickup" less than the determined current. This parameter is located in "Min Operate Current" block with the name of "Nom.Min.Op.Curr" and its value should be linked with "1.1" times of the nominal current. So, the formula is written as "1.1*NOMVAL". According to "IEC" standard, if the injected current is bigger than "20" times of the nominal current, the relay should give a trip at a "Definite" time. This parameter is located in "Max Operate Current" block with the name of "Nom.Max.Op.Curr" but in this video, we skipped entering the information of this parameter. It should be noted that the activeness of "Range Limits" value should be linked with another parameter in "Device Config" block. This parameter is located in "Timed Overcurrent Element" block with the name of "Use Range Limits". By repeating the mentioned steps for linking and selecting the "50/51" parameter and "Enumeration=Time Overcurrent IEC" with "ID=TXT_3_101", the formula is written as "OC_101=TXT_3_101" and after testing, the "OK" option is selected. You can find this parameter in "Elements" tab of "Overcurrent" block. If this option is enabled, the relay must not "Pickup" in current values less than "Imin".



State	Name	ID	Description	Value	Type	Min	Max	Formula
✓	Nom. Min. Op. Curr.	NOMVAL	Nominal minimum operate current	1.10 Iref	Real	na	na	1.1*NOMVAL
✓	Tolerance Absolute Positive	TOLABSPOS	Positive absolute tolerance	0.00 Iref	Real	na	na	
✓	Tolerance Absolute Negative	TOLABSNEG	Negative absolute tolerance	0.00 Iref	Real	na	na	
✓	Tolerance Relative Positive	TOLRELPOS	Relative positive tolerance	0.00 %	Real	na	na	
✓	Tolerance Relative Negative	TOLRELNEG	Relative negative tolerance	0.00 %	Real	na	na	
✓	Tolerance Actual Positive	TOLACTPOS	Resulting actual positive tolerance	0.00 Iref	Real	na	na	
✓	Tolerance Actual Negative	TOLACTNEG	Resulting actual negative tolerance	0.00 Iref	Real	na	na	
✓	Test Positive	TESTVALPOS	Positive tolerance for test	0.00 Iref	Real	na	na	
✓	Test Negative	TESTVALNEG	Negative tolerance for test	0.00 Iref	Real	na	na	
✓	Test Tolerance	TESTTOL	Additional tolerance for test equipment	0.00 %	Real	na	na	

Figure 12

Recalculate Disabled Formula(s) Quick Access Ok Cancel									
Timed Overcurrent Element - Timed overcurrent element (stage)									
	State	Name	ID	Description	Value	Type	Min	Max	Formula
	☒	Name	NAME	Name of the element (stage)	I#1 Phase	String			
	☒	Active	ACTIVE	Characteristic is operational	Yes	Boolean			OC 101=TX1 3 101 AND CURVE 51=TX1 1 51
	☒	Use Range Limits	USERANGE LIMITS	Range limits limit I(t) characteristic	Yes	Boolean			OC 101=TX1 3 101
	☒	Use Reset Characteristic	USERESET CHARACTERISTIC	Reset characteristic is operational	No	Boolean			
	☒	Reset Characteristic Type	RESET CHARACTERISTIC TYPE	Type of the reset characteristic	None	Enumeration			
	☒	Use Blinder	USEBLINDER	Blinder limits directional characteristic	No	Boolean			
	☒	Supervised Current	SUPERVISED CURRENT	Supervised Current	Phase	Enumeration			
	☒	Directional Mode	DIRECTIONAL MODE	Directional mode of the element	Non-Directional	Enumeration			

Figure 13

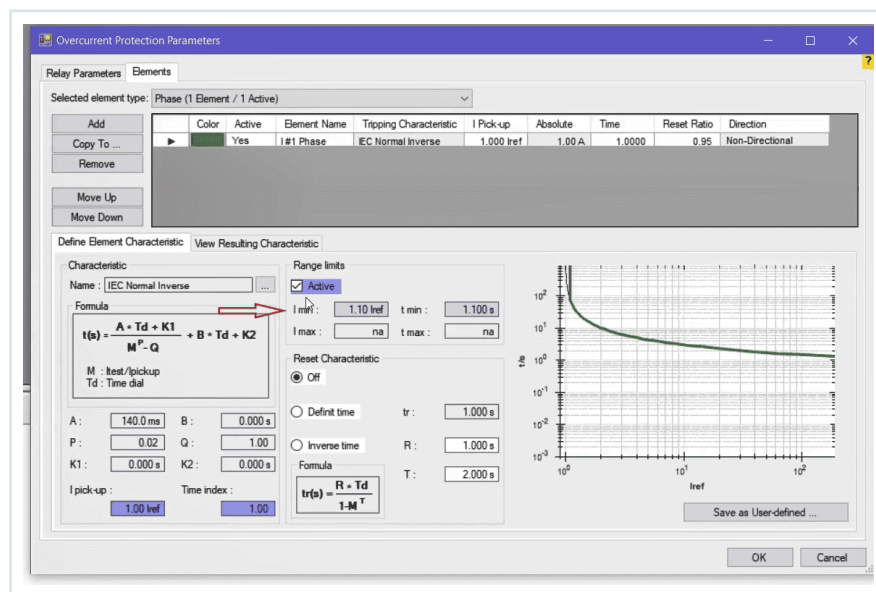


Figure 14

2 Final review:

The information regarding the curve is mentioned in the tree diagram of "Operating Curves" and "Standard Curve" blocks.

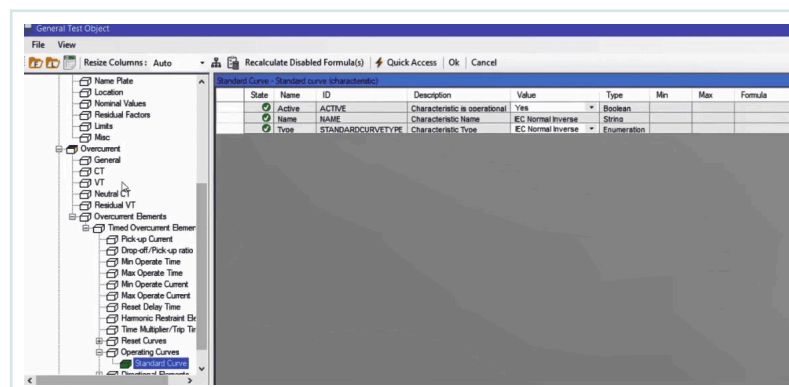


Figure 15

You can view the changes made by double-clicking on "Overcurrent" block. Under the "Relay Parameters" tab, the tolerance values are derived from the determined formula and its cell color is turned purple. Also, under the "Elements" tab, the parameters for which a formula is determined are turned purple. Then, click on "Ok" so save the settings. You can see that the "Normal Inverse" curve is displayed on "Overcurrent Characteristic" window.

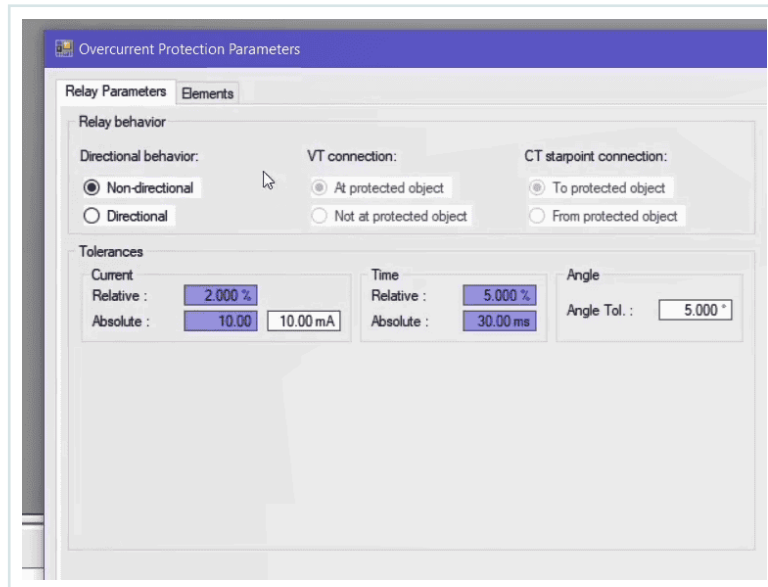


Figure 16

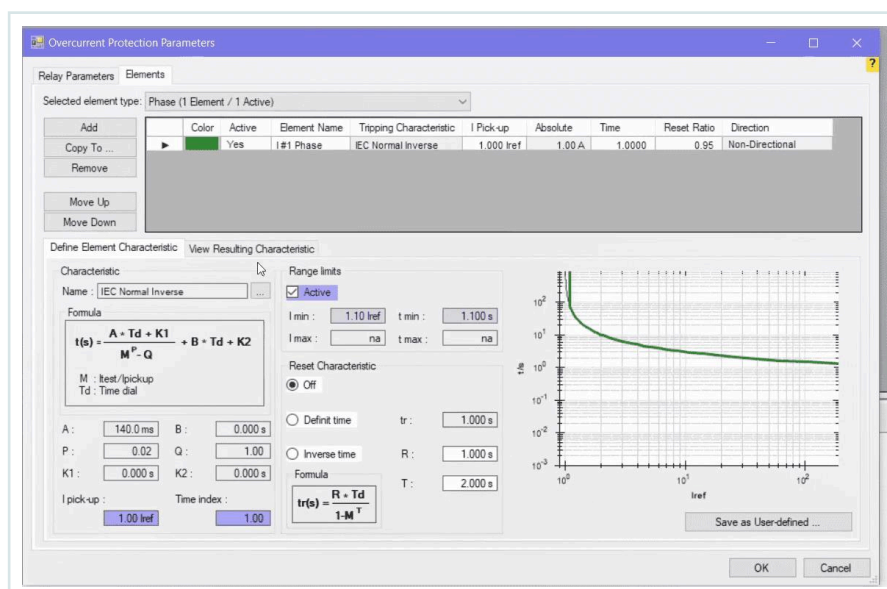


Figure 17

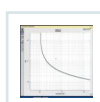


Figure 18

To further examine the validity of written "XRio" file, some cases are tested as a sample. To do this, "Disabled" is selected in "Device Config" block and then by double-clicking on "Overcurrent" block, you can see that the curve has been disabled. Also, by clicking on "Ok", no curve is displayed on "Overcurrent Characteristic" window.

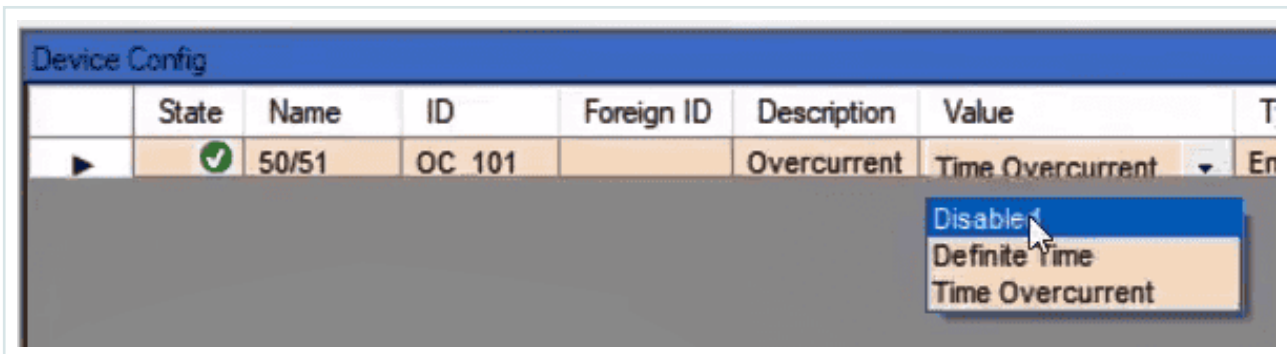


Figure 19

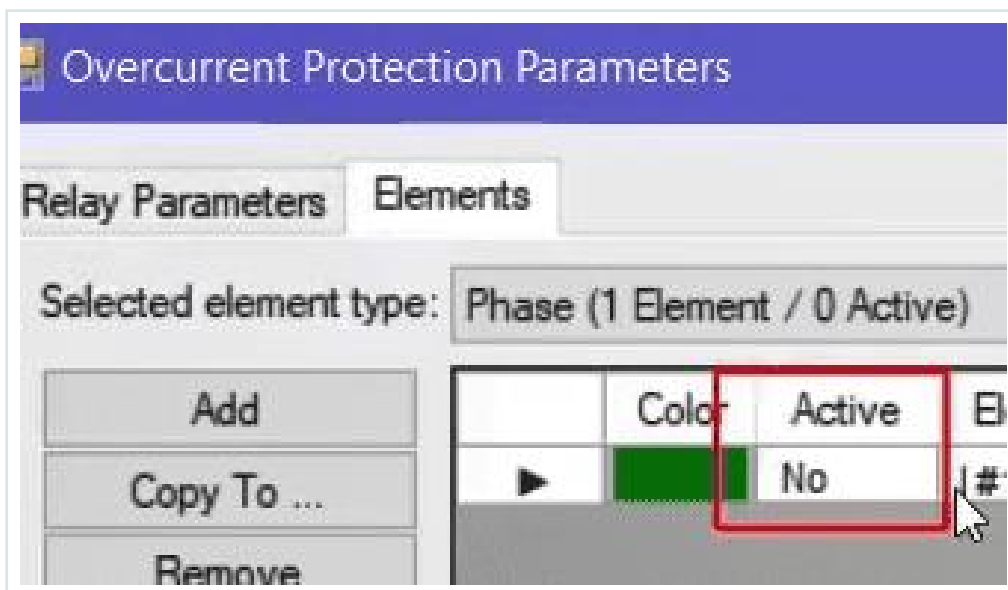


Figure 20

As another example, the value of "Time Overcurrent IEC" is selected in "Device Config" block and in "51" block, "Pickup 51=4A" is determined as the current value while "Time Dial 51=0.5" is determined as time. In the "Overcurrent" block it is observed that the same changes are made. For example, the minimum current value is "Ipickup=4.4A". After clicking on "OK", the changes are made to "Overcurrent Characteristic" window.

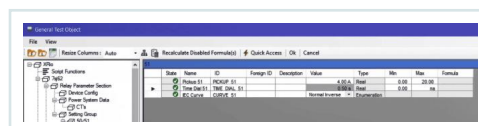


Figure 21

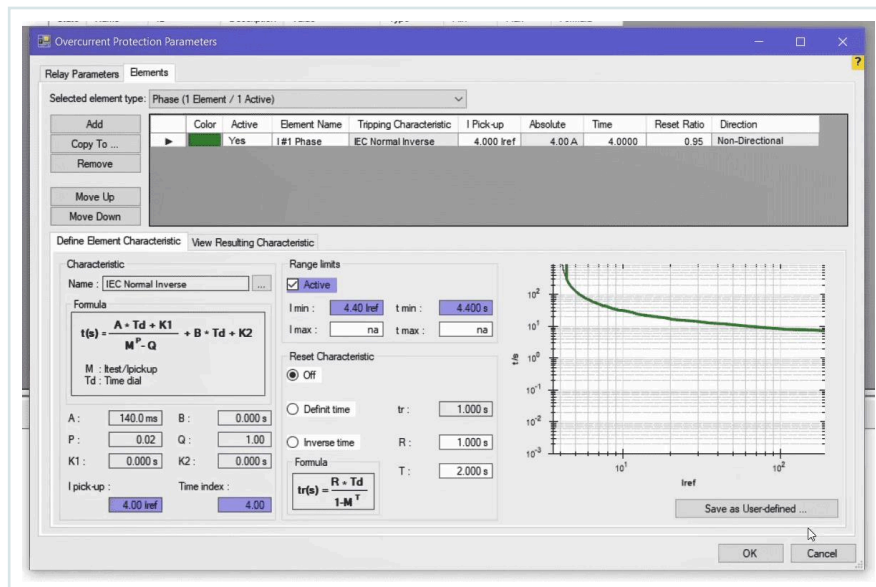


Figure 22

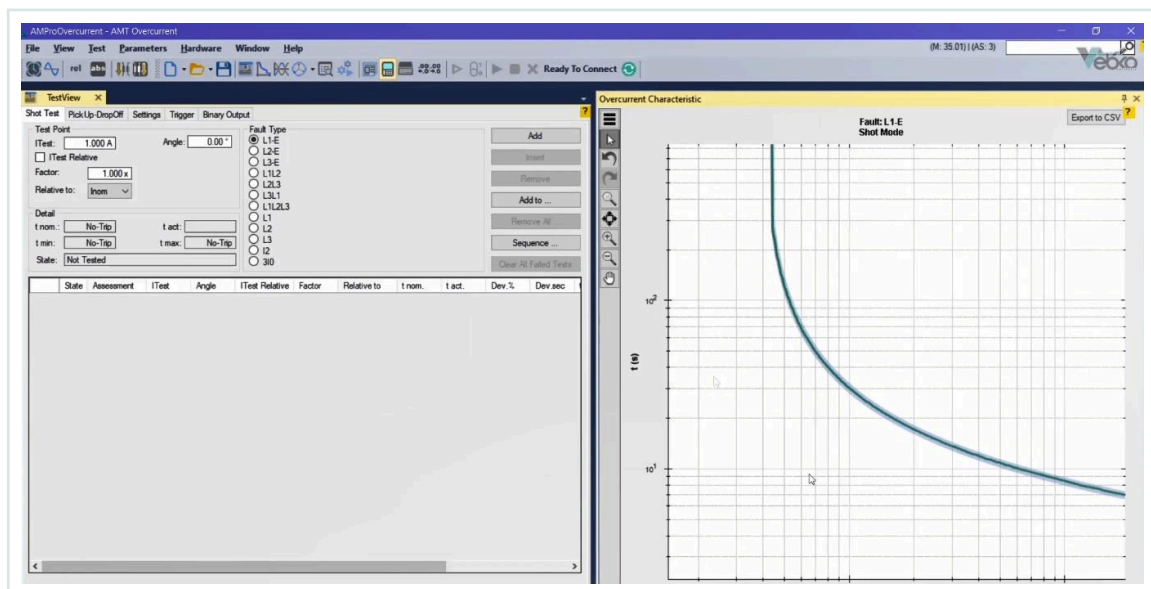


Figure 23

[jg1]Writing_formula_for_XRio_Converter5